

C-4.4 Apply the concept of moles to determine the number of particles of a substance in a chemical reaction, the percent composition of a representative compound, the mass proportions, and the mole-mass relationships.

Revised Taxonomy Level 3.2 B Apply conceptual knowledge

This concept was not addressed in physical science

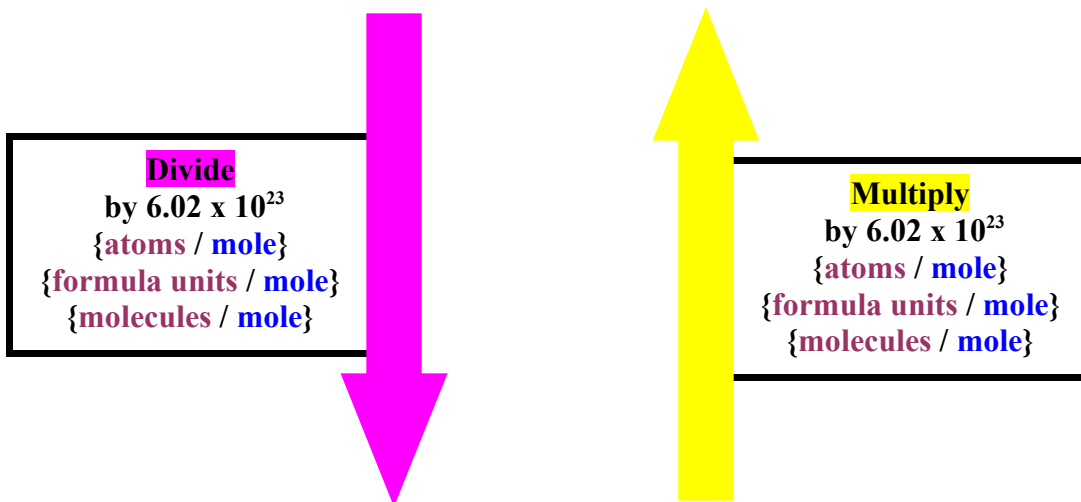
It is essential for students to

- ❖ Understand that the quantity 6.02×10^{23} of any object is defined as a “mole” of the object.
- ❖ Understand that the atomic mass of a substance, as found on the periodic table, represents the average mass (in atomic mass units) of the naturally occurring isotopes of the element.
- ❖ Understand that the molar mass of a pure substance is the mass (in grams) of one mole of the substance (the molar mass of carbon atoms is the mass (in grams) of one mole of carbon atoms).
- ❖ Understand that the molar mass of an element (measured in grams) is numerically equal to the atomic mass of the element (measured in atomic mass units)
- ❖ Understand that the formula mass is the term used for ionic substances. It is the sum of the atomic masses of all of the elements contained in one formula unit of an ionic compound.
- ❖ Understand that the molecular mass is the term used for molecular compounds. It is the sum of the atomic masses of all of the elements in the molecular formula of the substance.
- ❖ Calculate the formula mass or molecular mass of any given compound.
- ❖ Use molar mass, formula mass, or molecular mass to convert between mass in grams and amount in moles of a chemical compound. (see mole chart, pg 5)
- ❖ Calculate the number of molecules, formula units, or ions in a given molar amount of a chemical compound.
- ❖ Calculate the percent composition of a given chemical compound.

Assessment

The revised taxonomy verb for this indicator is implement (apply), the major focus of assessment will be for students to show that they can “apply a procedure to an unfamiliar task”. In this case, to apply the concept of mole theory to determine the mass or number of particles present in a given sample of a substance. Because the indicator is written as conceptual knowledge, assessments should require that students understand the “interrelationships among the basic elements within a larger structure that enable them to function together.” In this case, assessments must show that students can apply their knowledge of the relationship among mass, mole, and particle number quantities to solve novel problems.

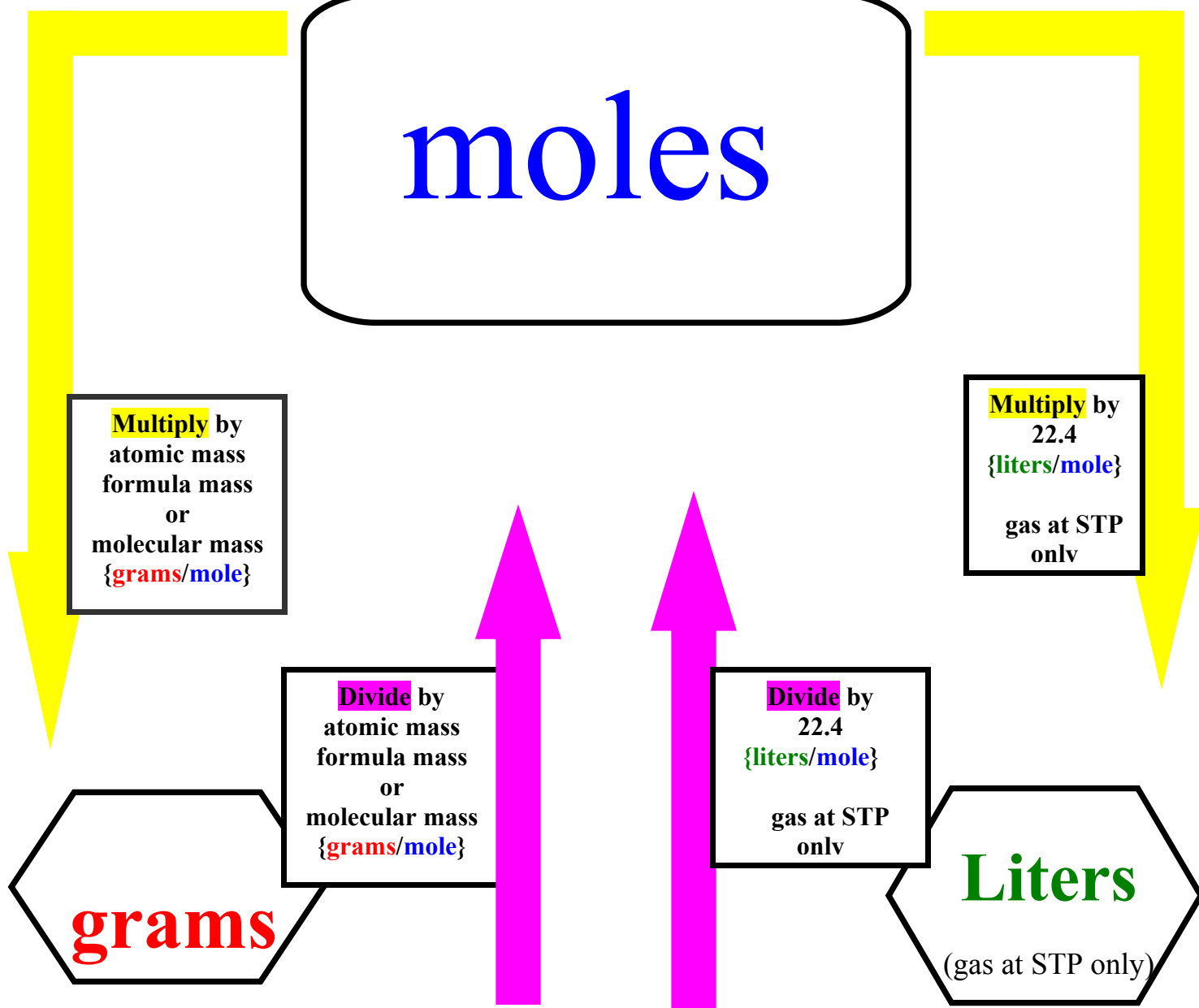
Atoms
Formula Units
Molecules



Divide
by 6.02×10^{23}
{atoms / mole}
{formula units / mole}
{molecules / mole}

Multiply
by 6.02×10^{23}
{atoms / mole}
{formula units / mole}
{molecules / mole}

moles



Multiply by
atomic mass
formula mass
or
molecular mass
{grams/mole}

Multiply by
22.4
{liters/mole}

gas at STP
only

Divide by
atomic mass
formula mass
or
molecular mass
{grams/mole}

Divide by
22.4
{liters/mole}

gas at STP
only

grams

Liters

(gas at STP only)

